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WIDER Working Paper 2021/74

The financial inclusion agenda

Examining the role of conventional banks in deepening access to formal credit

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April 2021

United Nations University World Institute for Development Economics Research
wider.unu.edu

Abstract: Using a unique district-level panel data set, we investigate the effect of banking system penetration on financial inclusion in Ghana. To purge potential endogeneity bias in the underlying relationship, we exploit a change in the policy environment of the Ghanaian banking system to instrument for banking system penetration. We show, first, that the switch from a compartmentalized system of banking to a universal banking system in Ghana has resulted in an expansion of banks' branch networks, which has benefited hitherto financially less developed districts. Second, our instrumental variable evidence suggests that banking system penetration promotes financial inclusion—notably, access to bank credit and to formal credit. The results of this paper provide important insights into the role of policy in enhancing financial inclusion.

Key words: financial sector development, banking system penetration, financial inclusion, pseudo panel, Ghana

JEL classification: C23, G28, G21, O16

Acknowledgements: The lead author would like to express his deepest gratitude to UNU-WIDER for sponsoring his PhD studies at the Department of Economics, University of Ghana. This paper is an outcome of these PhD studies. An earlier version of this paper was presented at the 3rd College of Humanities International Conference, University of Ghana, 18–20 July 2017, as 'Banking system penetration and financial inclusion: a pseudo panel data approach'. The authors would like to thank all participants at that session for their very useful contributions. Further, we would like to thank Peter Quartey, J. Atsu Amegashie, and Osman Ouattara for their important comments on an earlier version of the paper. However, we are solely responsible for any remaining error(s).

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This study has been prepared within the UNU-WIDER project Structural transformation – the old and new paths to economic development.

Information and requests: publications@wider.unu.edu

ISSN 1798-7237 ISBN 978-92-9267-012-2

https://doi.org/10.35188/UNU-WIDER/2021/012-2

Typescript prepared by Joseph Laredo.

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The Institute is funded through income from an endowment fund with additional contributions to its work programme from Finland, Sweden, and the United Kingdom as well as earmarked contributions for specific projects from a variety of donors.

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1 Introduction

It is well established that financial inclusion—which entails the provision of formal financial services, that is, savings, insurance, credit, and payment facilities, to poor households and microenterprises—has a substantially positive impact on welfare (Aghion and Bolton 1997; Banerjee and Newman 1993; Caskey et al. 2006; Danquah et al. 2017; Khandker and Samad 2014; Levine 2008). Specifically, micro-level studies show that households with access to financial services are economically better-off than those without (Khandker 2005; Khandker and Samad 2014; Luan and Bauer 2016). In addition, access to finance has often been cited as the main obstacle to the growth and transformation of small- and medium-size enterprises (SMEs) (Abor and Quartey 2010; Aryeetey 1994; Beck et al. 2008; Berg and Fuchs 2013; Bigsten et al. 2003; Quartey et al. 2017). Beyond the household- and firm-level effects of financial inclusion, it has also been suggested that economies with deeper financial intermediation are associated with higher growth performance, lower inequality, and macroeconomic stability (Beck et al. 2010; Bernanke and Gertler 1990; Jalilian and Kirkpatrick 2005). Ahamed and Mallick (2019) show that financial inclusion also promotes bank stability.

In spite of the significant developmental benefits that can be generated by a deeper level of financial inclusion, it remains a fact that such benefits are yet to be enjoyed by an extremely large number of individuals in the world. A report on the 2017 Global Findex database (Demirgüç-Kunt et al. 2018) revealed that, although there have been some improvements in the extent of financial inclusion, globally, over the past few years, about 1.7 billion working-age adults still have no access to formal financial services; this figure puts the percentage of the world's adult population without access to formal financial services at around 31 per cent (Demirgüç-Kunt et al. 2018). An understanding of the factors that potentially influence the extent of financial inclusion in a country is important for effective policy formulation on financial inclusion. Extant studies on access to financial services show that the availability of financial services (a supply-side factor) as well as demand-side factors matter in deepening the level of financial inclusion (Beck and de la Torre 2007; Claessens 2006; Kumar et al. 2019).

Beck et al. (2009) underscored the importance of geography, i.e. physical access to financial institutions, in relation to financial inclusion in the developing world. Recent developments in the financial sector landscape in the developing world suggest that conventional banks may have a role to play in deepening access to financial services, especially for low-income groups. Over the past few years, there has been considerable growth in the physical presence of bank branches across geographical locations as well as in the types of products and services offered by banks, most of which are targeted at low-income households, and the poor generally, throughout the developing world (Chibba 2009). For instance, in India, the banking industry has rolled out new products and services with the aim of addressing financial exclusion. In Ghana, aside from the growth in bank branch expansion in recent times, there have been significant changes in banks' product design and service outreach with the aim of attracting hitherto unbanked customers.

As in most parts of the developing world, Ghanaian banks pay interest on savings accounts and bank accounts can be opened with zero balances, although this was not the case prior to the 2000s. Furthermore, most Ghanaian banks have taken advantage of the strong growth in the ICT industry and the evolution of market-based approaches to serve the poor and unbanked by developing business alliances with non-financial firms in order to expand their outreach. Lending to SMEs is now a crucial part of Ghanaian banks' business models. These innovations in the Ghanaian banking system have the potential to increase the patronage of formal financial services, especially by those who are excluded from the formal financial system.

On the back of these developments, we exploit the policy environment of the Ghanaian banking system—specifically, the introduction of a universal banking regime in 2003, which matured fully in December 2006—to provide evidence on whether banking system penetration influences the extent of financial inclusion in Ghana. To this end, we use trend breaks in the relationship between initial financial development (see Section 5.2)—i.e. the number of bank branches per capita in a district in the base year—and bank branch placement to control for endogenous bank branch placement and also to identify the effect of banking system penetration on financial inclusion. Our reliance on the change in the policy environment of the Ghanaian financial sector allows us to circumvent the endogeneity problems that often bedevil causal analysis of this nature in empirical research. This approach assumes that the universal banking system that replaced the compartmentalized system of banking in Ghana may affect the level of financial inclusion indirectly through its impact on banking system penetration. This approach is similar to the identification strategy adopted by Almond et al. (2002), Burgess and Pande (2005), and Duflo (2001).[1]

We utilize a unique district-level panel data set constructed from three waves of the Ghana Living Standards Survey (GLSS)[2], complemented by administrative data on bank branch locations obtained from the Bank of Ghana.[3] The main findings of the paper are: first, the move to a universal banking system in Ghana resulted in an expansion of banks' branch networks, which benefited hitherto financially less developed districts. Second, our instrumental variable estimations suggest strongly that banking system penetration promotes financial inclusion in terms of access to both bank credit and formal credit. The findings of this paper point to the important role of policy in increasing the extent of financial inclusion.

Although several studies have chiefly explored the demand-side drivers of financial inclusion (Allen et al. 2016; Demirgüç-Kunt and Klapper 2013), there is little empirical evidence on the role of supply-side factors—in particular, banking system penetration—in determining the level of financial inclusion. The current study adds to the literature in two ways: first, it examines the effect of improving banking system penetration on access to financial services (or financial inclusion); second, this is done by relying on a change in the policy environment of the Ghanaian banking system to account for endogenous branch placement (i.e. correcting for a potential endogeneity bias). This approach provides important insights into the role of policy in increasing the extent of financial inclusion in Africa.

The remainder of the paper proceeds as follows: Sections 2 and 3 provide an overview of developments in Ghana's banking sector and a review of related literature, respectively. Section 4 explains the empirical strategy adopted by the paper and Section 5 provides a description of the data. Section 6 presents the empirical results of the study, and Section 7 concludes.

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[1] Almond et al. (2002) studied the role of health care access in black infant mortality rates using a county-level data set whilst exploiting an exogenous variation in black minority access to health care. Burgess and Pande (2005) exploited the introduction and cessation of a state-led rural branch expansion programme to provide evidence on the effect of banking system penetration on poverty in India. Duflo (2001) exploited a large-scale school construction programme undertaken by the Indonesian government to examine the causal influence of education on labour market outcomes.

[2] 1998/99 (GLSS 4), 2005/06 (GLSS 5), and 2012/13 (GLSS 6) (see Section 5 for details).

[3] Deaton (1985) argues that in the absence of genuine panel data sets, pseudo (synthetic) panels constructed from repeated cross-sections can be used to study relationships over time in a manner akin to genuine panels.

2 Background of the Ghanaian banking system

2.1 The universal banking licence (UBL) policy

Over the past few decades, the Ghanaian banking industry has witnessed a transformation partly due to the gradual but steady implementation of several banking sector reforms since the 1980s. By the early 2000s, several banking sector reforms had been implemented, including the Central Bank's decision to allow private and foreign banks to operate in the Ghanaian banking system, the removal of banks' minimum savings rate and sectoral credit controls, the liberalization of commercial banks' interest rates and bank charges, the increased supervisory authority of the Bank of Ghana, and the introduction of a universal banking licence regime. The universal banking licence (UBL) policy, which was promulgated in 2003 (though it did not fully mature until 2007) to replace the three-pillar banking model (wherein the Central Bank of Ghana issued operational licences to banks to undertake only one of three types of banking activities, namely, commercial, merchant, and development banking), was an attempt to improve the competitiveness of the banking industry and encourage product innovation and entry.[4] The UBL concept made the following changes to the Ghanaian banking system: (i) removal of restrictions on banking activity; (ii) removal of restrictions on branch network expansion for certain institutional types (e.g. merchant banks); (iii) allowance of banks to freely determine which segment of the market they operate in; (iv) increase in banks' minimum capital requirement from GH₵20,000 (ca. US$3,500) to GH₵7 million (ca. US$1.2 million). The satisfaction of the new minimum capital requirement was a precondition for the issue of a UBL and banks were required to comply with this directive by the end of December 2006.

Under the UBL concept, banks with UBLs have the liberty to engage in commercial, development, and merchant banking activities simultaneously without needing to acquire separate licences. This new system of banking therefore enabled all banks to offer products that were previously the preserve of specific banking sectors, while at the same time allowing them to diversify the range of financial services they offered. The UBL regime thus ended the commercial banks' monopoly in the area of retail banking by allowing other categories of banks, especially merchant banks, to compete for retail deposits. The UBL regime may therefore have helped ease the liquidity constraints of banks by increasing capital mobility—that is, by enabling banks to use the deposits of one sector (say, households) to make loans to another sector (say, businesses). Therefore, it was anticipated that the UBL regime would increase the competitiveness of the banking industry and thus force banks to expand their bank branch networks in order to broaden their customer base.

2.2 Evolution of the Ghanaian banking industry since 1999

The Ghanaian banking system, which hosted 16 banks in 1999 with about 300 bank branches, was home to 23 banks with 425 bank branches in 2006 (see Table 1). Although the Bank of Ghana had set the end of December 2006 as the deadline for the fulfilment of the capital adequacy requirement for banks to attain universal banking status, it was not until 2007 that all operating banks in the country had officially attained universal banking status (Adjei-Frimpong 2013). At the end of December 2006, only 16 of the operating banks in the Ghanaian banking industry had obtained a UBL, leaving behind seven banks, four of which were still operating as commercial

[4] Under the three-tier banking model, no single bank could operate in more than one dimension of banking activity. The system also imposed branch network restrictions on certain types of banking activities. For instance, merchant banks, which were designed primarily to provide wholesale banking services to businesses, could not hold savings accounts for individuals. Merchant banks were also constrained by their licence to branch out only within metropolitan areas.

banks while the remaining three operated as development banks (Table 1). As Table 1 shows, between 2007 and 2014, the number of bank branches in Ghana increased by over 113 per cent, indicating a surge in banking system penetration by about 514 additional bank branches.

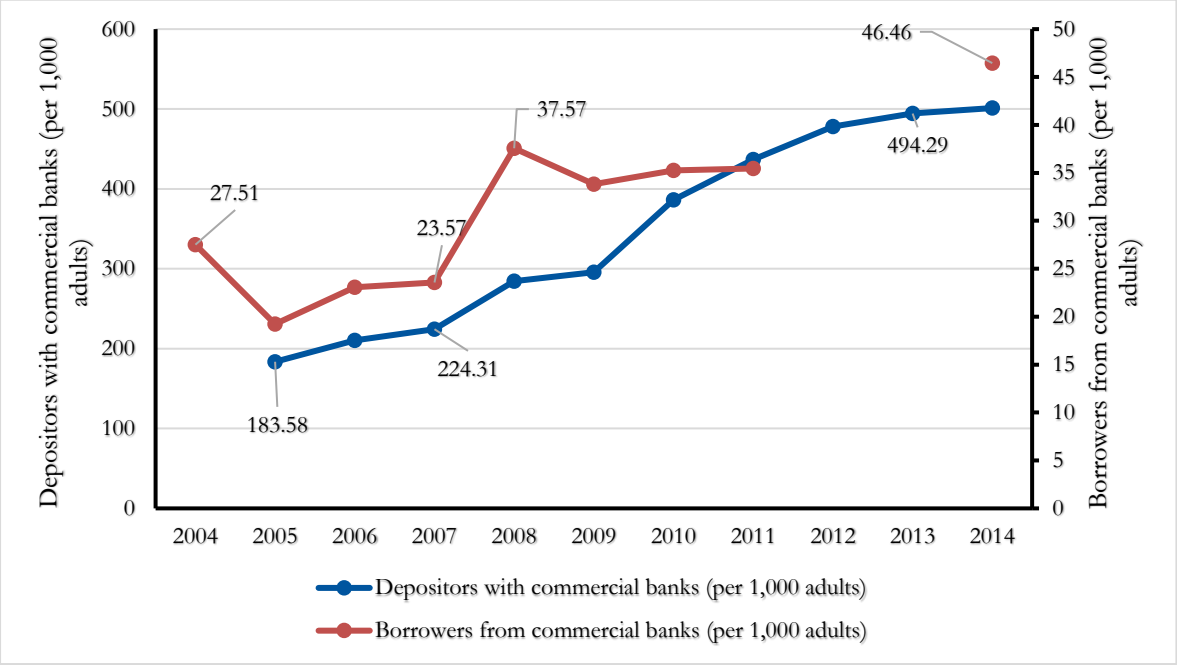
Table 1: Structure of the Ghanaian banking industry, 1999–2014 (selected years)

Banks	1999	2002	2003	2006	2007	2008	2010	2011	2012	2013	2014
Universal banks	0	0	3	16	23	26	26	27	27	27	28
Commercial banks	8	9	9	4	0	0	0	0	0	0	0
Development banks	3	3	3	3	0	0	0	0	0	0	0
Merchant banks	5	5	3	0	0	0	0	0	0	0	0
No. of major banks	16	17	18	23	23	26	26	27	27	27	28
No. of bank branches	300	309	295	425	453	619	776	795	870	892	967

Source: authors' construction based on Adjei-Frimpong (2013) and Bank of Ghana (2016).

Alongside the expansion of the bank branch network, primary financial inclusion indicators also point to positive developments in the extent of financial inclusion. For instance, the number of depositors with banks per 1,000 adults increased from fewer than 185 in 2005 to over 500 in 2014. The number of borrowers from banks per 1,000 adults also rose, from 27.5 in 2004 to over 46 in 2014 (Figure 1).

Figure 1: Trends in financial inclusion indicators in Ghana, 2004–14



Source: authors' illustration based on data from the World Bank's WDI data set (World Bank 2017).

2.3 Profile of households' sources of credit in Ghana, 1999–2013

Consistent with the country-level statistics on the profile of bank lending in Ghana over the past few years (as shown in Figure 1), we show, using household-level information on the sources of household credit obtained from the GLSS, that formal financial intermediaries (especially banks) have become an important source of household credit in Ghana. In 1999, the dominant source of household credit was the informal financial sector, which accounted for close to 90 per cent of total household credit (see Table 2). In contrast, less than 7 per cent of total household credit came from commercial banks (state and private). In subsequent years, especially the years after the

implementation of the UBL regime, there was a considerable increase in the proportion of total household credit sourced from the formal financial sector. In 2013, for example, close to 56 per cent of total household credit was obtained from this sector, with banks accounting for about half of this figure.

Table 2: Sources of household credit, GLSS 4, 5, and 6

Sources of credit	GLSS 4 (1998/99)	GLSS 5 (2005/06)	GLSS 6 (2012/13)
State bank	4.24	8.8	11.06
Private bank	1.92	6.54	16.03
Co-operative	1.65	4.12	5.88
Government agency	1.16	1.89	0.9
NGOs	0.41	1.67	2.51
Business firm	0.98	1.0	1.01
Employer	1.01	0.89	1.16
Money lender	4.7	3.34	3.67
Savings and loans scheme			16.88
Susu scheme			12.01
Trader	21.83	14.78	1.76
Farmer	2.37	2.15	1.66
Relatives/friends/neighbours	58.3	52.75	23.97
Other	1.43	2.05	1.51

Source: authors' computation based on GLSS 4, 5, and 6.

Meanwhile, the share of the informal financial sector (especially borrowing from relatives, friends, and neighbours) in household credit declined significantly. While about 60 per cent of total household credit was sourced from relatives/friends/neighbours in 1999, this incidence was much lower in the post-2006 period, constituting less than a quarter of total household credit in 2013. This represents an approximately 60 per cent decline in the contribution of borrowing from relatives/friends/neighbours in total household credit over the period 1999–2013. The observed decline in the share of household credit sourced from informal financial intermediaries over the years in favour of formal financial intermediaries may be due to the transformation of the financial sector landscape in Ghana in recent times. The trend in access to credit from banks, in particular, is an indication of growth in banks' engagement with the public, which could be due to the wider bank branch network and improvement in banks' product offerings.

3 Review of related literature

3.1 Theoretical literature

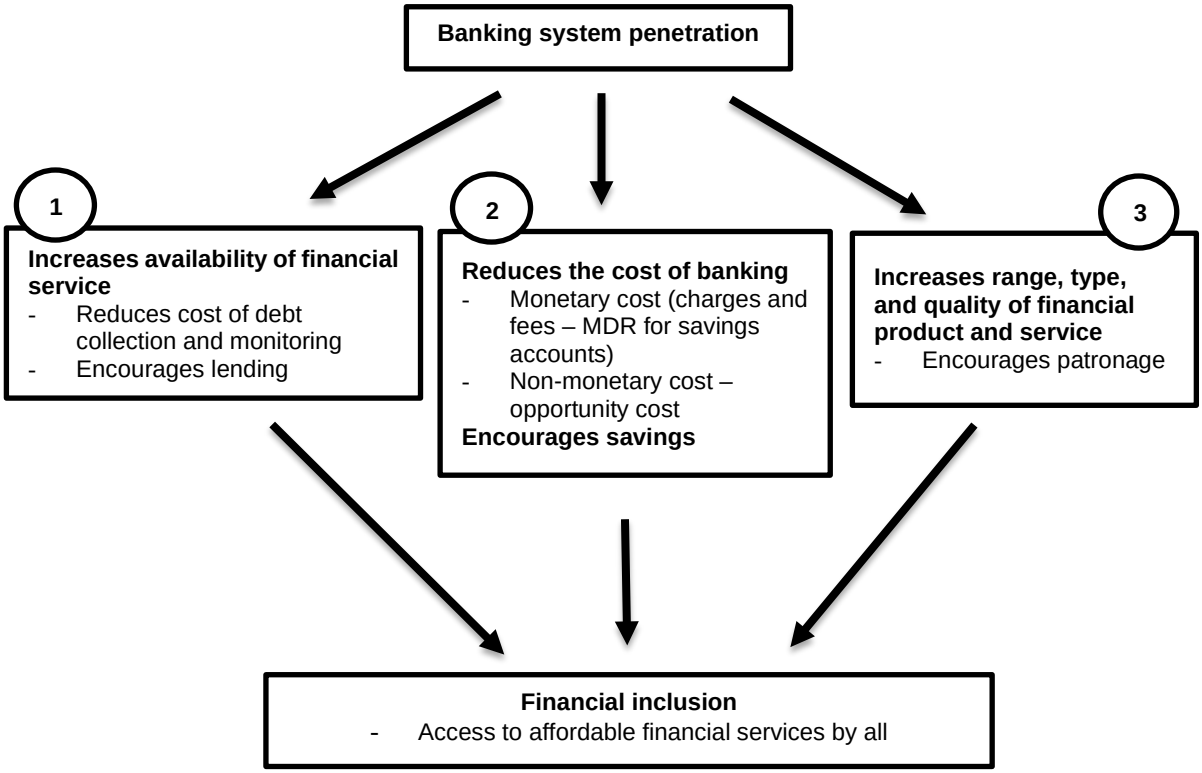
Financial institutions and markets provide intermediation services to economic agents by reducing the incidence of information asymmetries and high transaction costs, which often limit the direct pooling of an economy's savings for investment purposes (Beck et al. 2009). By producing and processing information about investors and investment projects, financial institutions efficiently direct the allocation of funds and help in diversifying, transforming, and managing risk (Levine 2005). Well functioning financial institutions and markets therefore critically support the accumulation of capital, with important consequences on the process of economic growth and development. Supply-leading theorists—notably, Schumpeter (1911), Patrick (1966), and Goldsmith (1969)—have presented arguments in support of the critical role that a developed financial sector can play in the economic transformation of a nation. Similar ideas have been

expressed by Gurley and Shaw (1955), McKinnon (1973), Shaw (1973), Romer (1986, 1990), Grossman and Helpman (1991), and Aghion and Howitt (1992). For instance, Gurley and Shaw (1955) noted the intermediation role played by a developed financial sector and its effect on economic growth. The authors focused on the transformation role of financial intermediaries in reducing the imperfections arising from maturity mismatch. In simple terms, they argued that financial intermediaries help to remove frictions between surplus-spending units (lenders) and deficit-spending units (borrowers).

Essentially, banks provide opportunities for risk-averse savers to hold bank deposits rather than liquid but unproductive assets. Savings held by banks can then be allocated optimally to other economic agents for productive investment. Thus, the presence of banks in an economy reduces the need to hold unproductive liquid assets—or consumption inventories in the context of underdeveloped economies—and hence effects an alteration of the composition of savings that is favourable to capital accumulation. Moreover, the presence of banks in an economy may reduce the incidence of self-financing of capital investments, thus ensuring that viable investments are not unduly liquidated. Bencivenga and Smith (1991) argue that, by promoting the availability of external financing for businesses, banks prevent the unnecessary liquidation of investments by entrepreneurs who might have had a need for liquidity. In summary, relative to a situation without banks (that is, financial autarchy), the presence of banks discourages the holding of savings in the form of unproductive liquid assets as well as preventing the misallocation of invested capital due to liquidity needs.

Banking system penetration may influence access to and/or utilization of financial services through the following channels: (i) improving the availability of financial services, geographically (for instance, an increase in the physical presence of banks makes the bank closer to its debtors, which may reduce the cost of debt collection and monitoring and encourage lending); (ii) reducing the cost of banking—that is, the price of financial services, including all monetary costs (e.g. bank charges and minimum deposit requirements for a savings account) and non-monetary cost elements (e.g. the opportunity cost of having to join long queues to be served by a teller or having to travel long distances to a bank branch)—potentially encouraging savings; (iii) an improvement in the range, type, and quality of financial services being offered. These three channels are summarized in Figure 2. Thus, banking system penetration promotes the realization of the four dimensions of access to financial services: reliability (is finance available when needed/desired); convenience (are services easy to access); continuity (can finance be accessed repeatedly); and flexibility (is the product tailored to the needs of customers) (Claessens 2006; Morduch 1999).

Figure 2: Banking system penetration and financial inclusion: causal mechanism



Note: MDR = minimum deposit requirement.

Source: authors' illustration.

3.2 Empirical literature

Empirically, a number of studies have examined the effect of banking system penetration on a range of outcome variables, including economic growth, poverty reduction, and financial inclusion (Binswanger and Khandker 1995; Burgess and Pande 2005; Chakravarty and Pal 2013; Eastwood and Kohli 1999; Guiso et al. 2006; Jayaratne and Strahan 1996). For example, Binswanger and Khandker (1995) employed district-level time series data spanning the period 1972/73 to 1980/81 to provide evidence on the impact of formal credit on a range of outcome variables, including agricultural output, investment, farm and non-farm employment, rural non-farm output growth, and rural wages, in India. The authors observed that the rapid expansion of commercial banks in rural areas had a positive influence on rural credit expansion. Specifically, the authors found that the expansion of rural credit was rapid in districts with a rapid growth in the number of commercial and co-operative bank branches.

In a related study, Burgess and Pande (2005) utilized a panel data set of 16 major Indian districts over the period 1961 to 2000 to shed light on the impact of the Indian Central Bank's financial inclusion-led rural banking system penetration programme on poverty reduction. Specifically, the authors exploited the imposition of the 1:4 bank branch licence rule in 1977 and its subsequent cancellation in 1990 to examine the impact of access to financial services on poverty and output. The authors found that the imposition of the 1:4 bank branch licence rule increased the number of rural bank branches established in less financially developed districts relative to more financially developed districts. The authors further observed that the large-scale expansion of commercial bank branches in rural India led to improved financial inclusion in rural India. That is, the expansion of commercial bank branches in rural areas improved access to commercial bank credit, making commercial banks the largest lender in rural India.

Chakravarty and Pal (2013), using state-level panel data covering 17 Indian states for the period 1972 to 2009, examined the effects of major banking policies on financial inclusion across states in India. Consistent with the findings of Burgess and Pande (2005), the authors found that the rural banking system penetration programme that was in force between 1977 and 1990 influenced the extent of financial inclusion across states in India. They concluded that geographic penetration of banks enhances financial inclusion.

Guiso et al. (2006) analysed the impact of bank deregulation on access to and cost of finance while exploiting the introduction of the 1936 Italian banking law and its repeal in the 1980s as a natural experiment. Specifically, the authors exploited the exogenous variation in the level of restrictions on bank competition across Italian provinces to provide evidence on the effects of bank regulation and on the impact of banking sector deregulation. Their results showed that bank deregulation led to an increase in competition in the banking industry.

Other studies have exploited bank branch deregulation policies to provide causal evidence on the effect of banking system penetration on economic growth, firm creation, poverty, and inequality. For instance, Jayaratne and Strahan (1996) exploited the natural experiment of a gradual relaxation of bank branch restrictions on state-wide branching and on the entry of out-of-state banks in the US to provide evidence on the effect of financial sector development on economic growth. They observed that the relaxation of bank branch restrictions led to an increase in bank presence across the different states, which in turn resulted in a 0.5–1.2 per cent increase in economic growth. In a similar study, Black and Strahan (2002) investigated the effect of policy changes—that is, the US branch deregulation programme—on entrepreneurship. They found that the deregulation of bank branch restrictions increased the rate of new firm incorporations by up to 8 per cent, while at the same time reducing the negative effect of concentration on new incorporations.

By further exploiting the branch deregulation experience across US states in the 1980s and 1990s, Beck et al. (2010) examined the impact of deregulation on income distribution. In particular, to address some of the concerns related to cross-country regressions such as endogeneity and measurement error, the authors exploited the cross-state and cross-time variation, thus accounting for state- and time-fixed effects, to provide evidence on whether liberalizing restrictions on intra-state branching in the US had an influence on income distribution. They found that bank branch deregulation led to a decrease in income inequality, largely through its effect on labour market conditions. More specifically, the authors argued that the effect of financial deepening on income inequality was not only statistically significant but also economically significant as over 60 per cent of the cross-state, cross-year variation in income distribution could be attributed to the removal of branch restrictions.

Raj et al. (2014) shed further light on the effect of banking sector development on firm establishment in India. Using district-level panel data spanning the period 1994/95 to 2010/11, the authors showed that local bank availability relates positively with the establishment of firms in the informal sector.

Other studies have relied on data from the World Bank's Global Findex database to provide evidence on individual- and country level determinants of financial inclusion. Allen et al. (2016), for instance, used the Global Findex data set for 123 countries to investigate the individual- and country-level determinants of financial inclusion, focusing on two measures of financial inclusion, namely, ownership of a bank account and saving on a bank account. They found that several individual characteristics, including income and education, positively impact financial inclusion.

Similarly, Demirgüç-Kunt and Klapper (2013) examined the use of financial services and the determinants of financial inclusion in 148 countries. In relation to the determinants of financial

inclusion, they estimated models on the effect of various individual and country characteristics on three main indicators of financial inclusion: ownership of a bank account, savings on a bank account, and the use of bank credit. The authors revealed that income significantly explains the level of financial inclusion both among individuals and across countries.

More recently, Leon and Zins (2020) have provided evidence on the role of regional foreign banks in widening financial inclusion in Africa. The authors combined three types of data in their empirical exercise: individual-level data sourced from the World Bank Global Findex database, firm-level data sourced from the World Bank Enterprise Surveys, and a hand-collected database on the presence of regional foreign banks. The study showed that the presence of regional foreign banks improves households' and firms' access to credit. Beck (2015) had also shown that the presence of foreign banks from emerging countries increases firms' access to credit, while the presence of foreign banks from developed countries relates negatively with firms' access to credit in Africa.

In sum, the above discussions reveal that literature on the role of banks in promoting financial inclusion exists, and it strongly suggests that banking system penetration promotes financial inclusion. However, the literature is silent about the effect of banking system penetration on financial inclusion using data from Africa. Against this backdrop, this paper seeks to provide evidence on the effect of banking system penetration on financial inclusion using data from an African context. In doing so, we exploit the policy environment of the financial system in Ghana to purge potential endogeneity bias in the relationship between banking system penetration and financial inclusion.

4 Empirical estimation strategy

4.1 Identification strategy

Causal empirical investigations are often bedevilled by concerns of endogeneity, arising from errors in measurement, simultaneity, and misspecification. In the presence of a potentially endogenous regressor, meaningful inferences can be drawn only from the use of estimation techniques or methods that address such endogeneity concerns. Given that the current paper seeks to shed light on the role of banking system penetration (in other words, bank branch expansion) in financial inclusion, our measure of banking system penetration is potentially endogenous and so requires us to employ techniques that addresses this problem. To this end, we show the policy-driven nature of banking system penetration in Ghana and use this policy as an instrument for banking system penetration in our model of the determinants of financial inclusion. This identification strategy is in line with the approach adopted by Duflo (2001) for Indonesia and Burgess and Pande (2005) for India.

A simple way to examine the effect of banking system penetration on financial inclusion at the district level would be to estimate, for district *i* in year *t*, an OLS regression of the form:

$$F_{it} = \alpha_i + \beta_t + \emptyset B_{it} + \varepsilon_{it} \quad (1)$$

where F_{it} represents the level of financial inclusion for district *i* at time *t*; B_{it} represents bank branch expansion in district *i* at time *t*, computed as the total number of bank branches per capita operating in district *i* at time *t*; α_i and β_t are region- and year-fixed effects, respectively; and ε_{it} is the random error term. Evidence from the above reduced-form model is, however, problematic. Indeed, a causal interpretation of the estimated $\emptyset$ parameter from equation (1) may be elusive. In

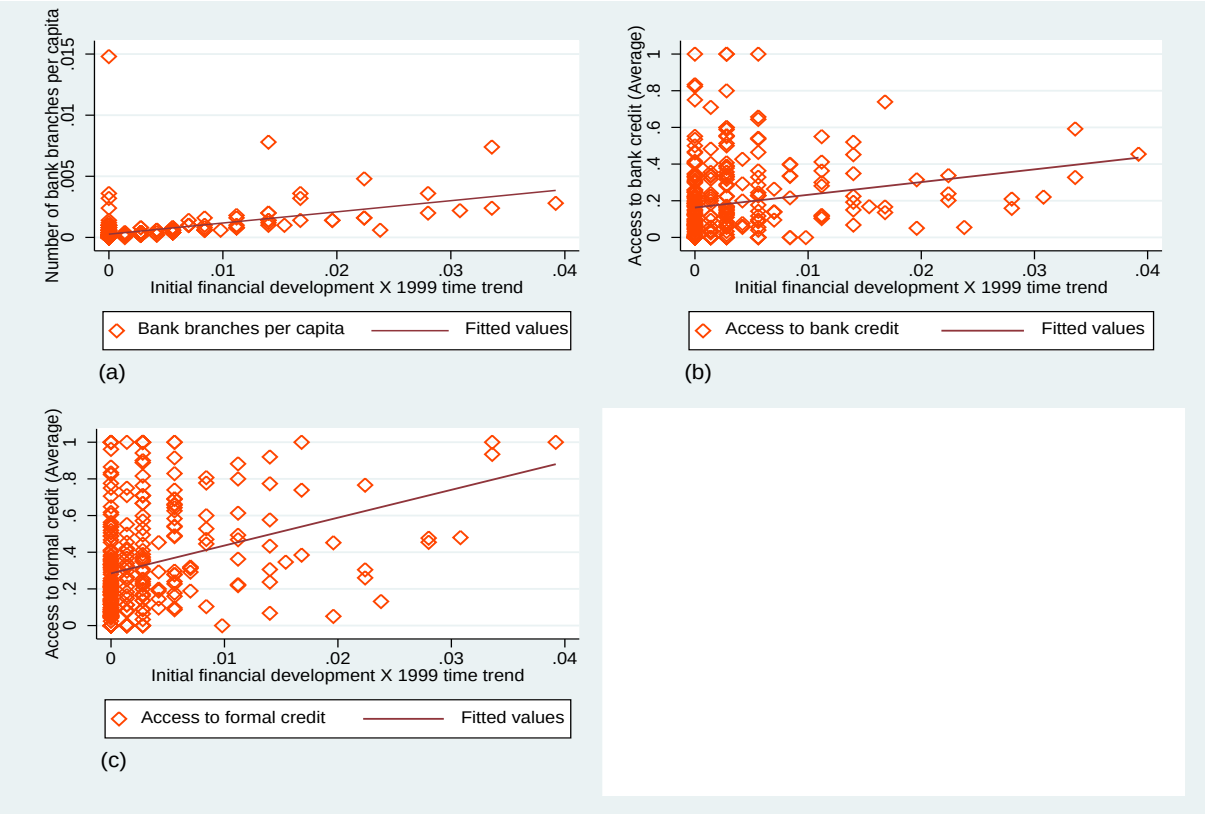
the absence of any policy change in the nature of banking business in Ghana we would expect that banks will situate branches in their 'restricted' service areas or in more financially developed areas. The case of merchant banks, for example, suggests that such banks would operate branches only in the metropolises, which are likely to be areas with a high degree of financial inclusiveness. So, if financially included districts are relatively effective in deepening the level of financial inclusiveness, then $\emptyset$ will likely overestimate the true financial inclusion impact of banking system penetration. This problem can be solved if we have an instrument for banking system penetration.

We argue that the change in policy regime (that is, the switch from the compartmentalized system of banking to the universal banking regime) in the banking industry can serve as an instrument in this case. As mentioned earlier, prior to 2007, Ghanaian banks were issued different licences to operate as either commercial, merchant, or development banks and the Ghanaian Central Bank imposed restrictions on the branching capacity of merchant banks in particular. This system encouraged banks to branch out only in financially more developed areas or focus on serving their 'restricted service areas'. The compartmentalized system of banking was associated with very low levels of competition among banks and so there was little incentive for banks to expand their branch networks or to develop innovative banking products.

The shift to the universal banking regime arguably introduced a high degree of commonalities in the activities of banks and thus potentially engendered a high level of competitiveness in the banking system (see Isshaq and Bokpin 2012). Indeed, by eliminating compartmentalization in the banking industry, as well as by raising the minimum capital adequacy requirement for banks, the universal banking regime has promoted a change in the business model of banks towards a point where all banks can offer financial products and services ranging from retail banking to corporate and wholesale banking. The convergence in the products and services offered by banks in the financial system undeniably fosters some degree of competitiveness and this may provide an incentive for banks to expand their outreach by establishing physical bank branches across the country, notably in previously less financially developed communities.

However, a theoretically plausible weakness of our proposed instrument is that, even though the Central Bank has removed constraints on branching, there is no directive on *where* banks should open their branches—i.e. whether in financially less developed or financially more developed areas. The inherent competitiveness of the universal banking system, however, should cause banks to expand their branch network and this expansion may be more pronounced in financially less developed areas (depending on the market size and profitability of the area). Consequently, we posit that, if the post-2006 bank licensing regime had any impact, it should have caused banks to branch out *relatively* more into financially less developed communities during the post-2006 period. The post-2006 phenomenon in how a district's initial financial development affects banking system penetration may constitute a valid instrument for banking system penetration if, relative to the pre-2007 trend, this incidence is significant and has no direct impact on financial inclusion. Figure 3 provides a bird's eye view of the reliability of our proposed instrument. In panel (a), we show that, in general, banking system penetration exhibits a *strong* positive relationship with initial financial development; however, the same cannot be said of the relationship between initial financial development and our financial inclusion indicators—i.e. access to bank and formal credit (see panels (b) and (c)). Indeed, the relationship between the initial financial development variable and the two financial inclusion indicators is *weakly* positive.

Figure 3: Relationship between initial financial development and banking system penetration and access to bank and formal credit



Source: authors' construction.

To empirically examine the plausibility of our proposed instrument, we estimate a fixed effects regression of the form:

$$B_{it} = \alpha_i + \beta_t + \gamma_t B_{i1999} + \delta_t Z_{i1999} + \varepsilon_{it} \quad (2)$$

where α_i and β_t are region- and year-fixed effects, respectively; B_{it} is the number of bank branches per capita in district *i* at time *t*, which represents our indicator of banking system penetration, and B_{i1999} is the number of bank branches per capita in the i^{th} district in the base year—1999 for the purpose of this study. This represents our measure of initial financial development for the i^{th} district. B_{i1999} enters the regression interacted with year dummies, with the γ_t coefficients capturing the year-wise effect of initial financial development on banking system penetration. The difference between γ_{t+1} and γ_t indicates how a district's initial financial development affects bank branch expansion in the district between years *t* and *t+1*.

In order to ensure that convergence in economic activity across districts in Ghana is not driving the observed relationship between initial financial development and banking system penetration, we include a vector of other control variables (Z_{i1999}). These variables attempt to capture the effect of other initial conditions in a district that may have a time-varying effect on banking system penetration. Included in this vector are factors such as the logarithm of real district welfare per capita, the population density of a district, the level of human capital endowment of a district, and the proportion of rural locations in a district, all measured in 1999. Like the initial financial development indicator, these controls also enter the regression interacted with year dummies; δ_t coefficients are the year-wise effects of the control variables on banking system penetration.

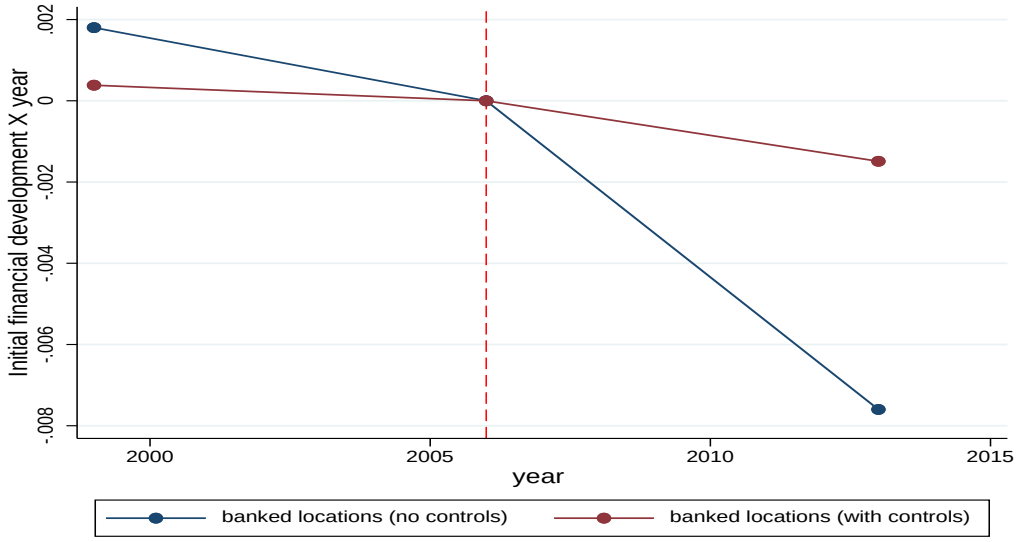
From equation (2) we can deduce a linear trend break model as follows:

$$B_{it} = \alpha_i + \beta_t + \gamma_1(B_{i1999} * [t - 1999]) + \gamma_2(B_{i1999} * [t - 2006]) + \gamma_3(B_{i1999} * P_{2006}) + \varepsilon_{it} \quad (3)$$

where $[t - 1999]$ and $[t - 2006]$ are linear time trends that turn on in 1999 and 2006, respectively, and enter the regression interacted with our measure of district *i*'s initial financial development (i.e. B_{i1999}). P_{2006} is a dummy variable that assumes a value of 1 in the post-2006 period and 0 otherwise. The main coefficients of interest in equation (3) are γ_1 and γ_2. These coefficients measure the average 1999–2006 trend relationship between a district's initial financial development and its banking system penetration, and the subsequent change in this relationship—i.e. between 2006 and 2013. γ_3 measures the intercept change in the underlying relationship in 2006.

As in equation (2), we also include the set of additional controls, Z_{i1999}, to capture a district's economic and demographic characteristics; this enters the regression in the same way as B_{i1999}. Region- and year-fixed effects account for permanent differences across regions and national events as well as other developments in the financial industry such the rapid expansion in the non-bank financial services sub-sector, which may affect banking system penetration. Given that a problem of serial correlation in the errors often arises when one applies the difference-in-differences estimation technique on a panel data set, we attempt to circumvent this possibility by clustering the standard errors by district (see Bertrand et al. 2004; Burgess and Pande 2005). A formal test of the validity of our proposed instrument is presented in Table 5. A graph of the coefficients in Table 5 is presented in Figure 4. We plot the γ_t coefficients from an estimation of equation (3). In this way, we show that the γ_t coefficients decrease with time and that this decrease is more pronounced in the post-2006 period, indicating the presence of a relatively higher bank branch opening in financially less developed districts during this period.

Figure 4: Initial financial development and banking system penetration



Note: the series 'banked locations (no controls)' and 'banked locations (with controls)' plots the annual coefficients on initial financial development (measured by the number of bank branches per capita in 1999) from the estimation of equation 3.

Source: authors' construction.

4.2 Instrumental variable model

Based on the results obtained by estimating equation (3), we would use the deviation (if any) in the trend relationship between initial financial development and branch expansion that is caused by the change in the bank licensing regime after 2006 as an instrument for banking system penetration. Thus, our first-stage regression is equation (3), while the second-stage regression can be expressed formally as:

$$F_{it} = \alpha_i + \beta_t + \phi B_{it} + \eta_1([t - 1999] * B_{i1999}) + \eta_2(P_{2006} * B_{i1999}) + u_{it} \quad (4)$$

where all variables maintain their usual meanings. The deviation from the linear district-specific trend $[t - 1999] * B_{i1999}$, which we characterize as $B_{i1999} * [t - 2006]$, is our instrument for banking system penetration (B_{it}). Implicit in this strategy is the assumption that the instrument affects the extent of financial inclusion in a district only through its effect on banking system penetration. This assumption will be shown to be valid (see Tables 5 and 6).

5 Data and descriptive statistics

This study utilizes a unique district-level data set constructed from household survey data sets and administrative data on the location of bank branches in Ghana. Our household survey data are drawn from the Ghana Living Standards Survey (GLSS), which is a nationally representative repeated cross-sectional survey of households in Ghana. Specifically, using three waves of the Ghana Living Standards Survey—GLSS 4 (1998/99), GLSS 5 (2005/06), and GLSS 6 (2012/13)—we construct a three-period (i.e. 1999, 2006, and 2013) district-level panel.[5] This process is, however, not without challenges, especially regarding the addition of district-level information in GLSS 6 to that of GLSS 4 and 5. This difficulty is, however, not present in the process of appending district-level averages of our variables of interest in GLSS 4 and GLSS 5, since both surveys were based on the same set of 110 districts.

Through creation and re-designation, the number of districts in Ghana increased over the period, from 110 districts in the late 1990s to 138 in 2006, 170 in 2008, 216 in 2016 (currently 254). Thus, the fourth wave of the GLSS, which was conducted in 1998/99, collected information on only 102 districts (out of the 110 districts that existed at the time), while the fifth and sixth waves of the GLSS collected information on 110 districts and 170 districts, respectively. Table 3 presents the key features of the last three rounds of the GLSS.

Table 3: Key features of the GLSS, waves 4–6

Item	GLSS 4	GLSS 5	GLSS 6
Regions	10	10	10
Districts	102	110	170
Clusters/EA	300	580	1,200
Households	5,998	8,687	16,772
Individuals	26,411	37,128	72,372

Source: authors' computation based on GLSS.

[5] Unlike earlier waves, the three waves of the GLSS used in this study are also identifiable at the district level. In other words, aside from being geo-referenced at the primary sampling unit (PSU) level, they also contain district codes of households' locations. Districts are the second-level administrative sub-division of Ghana below the level of region.

Two main issues arise in constructing the district-level data set using GLSS 4. First, inconsistent with the coding scheme employed in GLSS 5 and 6, the GLSS 4 treated Atebubu and Sene—two adjoining districts in the Brong Ahafo region—as one district, even though at the time of the survey they were already separate districts. To address this anomaly and to ensure consistency with GLSS 4, we merged these two districts into a single district in the subsequent waves of GLSS. Second, GLSS 4 did not collect information on the following districts: South Tongu, Berekum, Zabzugu-Tatale, Yendi, Savelugu-Nanton, Tolon-Kumbungu, and Sissala. To ensure consistency, and especially for the purpose of our identification strategy, we omitted data on these districts in the two subsequent waves of the GLSS.

Thus, for the purpose of having a balanced panel and more consistent district-level data, we restricted the number of districts to 102 (base year sample size). Given that the expansion in the number of districts over time is largely due to the splitting or division of old districts into two or more new districts, we built the same 102 districts from the 170 districts contained in the GLSS 6. Specifically, we carefully identified the origin of all the additional 60 districts contained in the GLSS 6 using information on districts in Ghana available from the Ministry of Local Government and Rural Development as well as online resources such as the web pages of the various district assemblies in Ghana. Using this information, we carefully merged the data on all newly created districts contained in GLSS 6 with the data on their 'mother' districts as in GLSS 4 and 5. This process allowed us to create a consistent and balanced panel of 102 districts over the three-wave period, yielding 306 observations.

The derived district-level data were then complemented with data on bank branches obtained from the Bank of Ghana. The bank branch data provide information on the number of banks that operated in each of the survey years—1999, 2006, and 2013—and branch locations. The locational information on all existing bank branches enabled us to map each bank branch onto the respective district. From this we computed the total number of bank branches in each district for each of the survey years. This process involved the use of a district map of Ghana containing detailed information on the communities in each district.

5.1 Dependent variables

The dependent variable considered in this paper is access to formal financial services—that is, financial inclusion. Even though financial inclusion is often proxied by indicators such as access to a formal bank account, access to a savings account at a formal financial institution, access to an insurance facility from a formal financial institution, and access to formal credit (Beck et al. 2009; Demirgüç-Kunt and Klapper 2013), in this paper we focus on a single dimension of financial inclusion, namely access to formal credit—that is, credit advanced by formal financial intermediaries such as banks, co-operatives, government agencies, and non-governmental organisations (NGOs). This approach is informed by the inadequate information on the other dimensions of financial inclusion in our data set, especially regarding waves 4 and 5 of the GLSS. More specifically, unlike GLSS 6, both GLSS 4 and 5 do not contain information on ownership of a formal bank account or on whether or not an individual holds an insurance facility offered by a formal financial institution. Also, the GLSS data sets (except the sixth wave) do not contain comprehensive information on the ownership of a formal savings account.

Using the information on access to formal credit, we do, however, define two financial inclusion proxies: (i) a narrower definition that concentrates on access to bank credit and (ii) a broader definition that looks at access to credit from formal financial institutions including banks. Consequently, in our empirical analysis we use two alternative measures of financial inclusion—that is, access to bank credit and access to formal credit. This approach is useful because it allows us to more appropriately capture the financial inclusion effects of banking system penetration. Put

differently, it sheds light on how banking system penetration specifically influences access to financial services provided by banks—that is, access to bank credit.

5.2 Independent variables

i. Banking system penetration: This is our indicator of banking system penetration and it is a simple count of the total number of bank branches opened/operating in a district per capita. Three measures of banking system penetration are defined: (1) cumulative number of bank branches operating in a district divided by 5,000[6]; (2) cumulative number of bank branches operating in a district divided by the population figure of that district in the year 2000 (the population figures used here are derived from both GLSS 4 and the 2000 Population and Housing Census (see Coulombe 2005)); (3) cumulative number of bank branches operating in a district divided by the land area of that district (this measure was also used by Binswanger et al. 1993).

ii. Initial financial development: We identify a district's initial financial development by the number of bank branches per capita in that district in the base year. For instance, when we use 1999 as the base year, our initial financial development indicator for each district is computed as the total number of bank branches per capita in a district in 1999.

iii. Control variables: We include several initial conditions in a district as control variables to capture any time-varying effect they may have on banking system penetration as well as on financial inclusion. These variables are the real district welfare per capita, the population density of a district, the human capital endowment of a district, and the proportion of rural locations in a district, all measured in the base year.[7]

Summary statistics of our regression variables are presented in Table 4. A description of the variables contained in Table 4, however, is noteworthy: *Bank credit* captures the share of total household credit obtained from banks; *Formal credit* captures the share of total household credit obtained from formal financial intermediaries; *Banking system penetration* measures the total number of bank branches operating in a district in a given year; *Initial financial development* captures the number of bank branches operating in a district in the base year, 1999; *Welfare per capita* is the logarithm of a district's welfare per capita and captures the income level of a district; *Population density* is the population density of a district and it is computed by dividing each district's population by the land area of the district, the district population figure being the 2000 figure, sourced from Coulombe (2005); *Human capital* measures the human capital endowment of a district and is calculated as the proportion of the adult population (individuals aged 18+ years) in a district with schooling experience; *Rural locality (proportion)* captures the extent of urbanization in a district and is measured as the share of rural communities in a district. The welfare measure (*Welfare per capita*) is adjusted to reflect changes in the value of the Ghanaian currency through the 2007 currency redenomination exercise carried out by the Bank of Ghana, which converted 10,000 cedis (old currency unit) to 1 cedi (new currency unit); thus, all monetary values in the fourth and fifth waves of the GLSS are divided by 10,000 in order to ensure consistency with the values obtained from GLSS 6.

[6] The choice of 5,000 is informed by the fact that the Ghana Statistical Service considers an area as urban if it has a population of 5,000 or more (see GLSS 2014).

[7] We compute real district welfare per capita as the mean household welfare per capita in each district. Household welfare per capita is computed as the total household consumption expenditure per equivalent adult and adjusted for variations in prices across households.

Table 4: Summary statistics of regression variables

Variable	Observations	Mean	Std. Dev.	Min.	Max.
Bank credit	300	0.19	0.21	0	1
Formal credit	300	0.35	0.31	0	1
Banking system penetration	306	5.45	24.49	0	373
Initial financial development	306	4.35	10.76	0	74
Welfare per capita	306	13.78	0.39	12.60	14.56
Population density	306	261.78	753.26	7.95	5,490.67
Human capital	306	0.61	0.21	0.03	0.90
Rural locality (proportion)	306	0.71	0.27	0	1

Source: authors' computation based on GLSS data and Bank of Ghana data on bank branch locations.

6 Results and discussion

This section presents the main empirical results of the paper. First, we show the soundness of our identification strategy by providing evidence on the validity of our chosen instrument. As mentioned earlier, this step involves a demonstration of a change in the relationship between initial financial development and banking system penetration in a district in the post-2006 period relative to the pre-2007 period. We also show that our indicators of financial inclusion are not significantly related with initial financial development, especially during the post-2006 period. These two facts (if established) would provide a sound basis for the use of our chosen instrument for banking system penetration in our attempt to identify the impact of banking system penetration on financial inclusion. Second, we then exploit the policy-driven nature of banking system penetration to provide evidence on the relationship between banking system penetration and financial inclusion.

6.1 Banking system penetration and initial financial development

Table 5 reports the results of the test of the suitability of our proposed instrument (i.e. the linear trend model presented in equation (3)). Column I of Table 5 presents the results of the effect of initial financial development on banking system penetration without the inclusion of other control variables, while column II presents the empirical results of the effect of initial financial development and other control variables on banking system penetration. Our results show, first, that the inclusion (or exclusion) of other control variables in our model does not alter the effect of the initial financial development variables on banking system penetration. The empirical estimates (column I of Table 5) suggest that banking system penetration and initial financial development are positively related in the pre-2007 period.

Table 5: Banking system penetration as a function of initial financial development

	Banking system penetration	
Variables	**I**	**II**
Number of bank branches per capita in 1999*(1999–2013) trend	0.030***	0.023***
	(0.004)	(0.006)
Number of bank branches per capita in 1999*(2006–2013) trend	-0.017***	-0.023***
	(0.003)	(0.005)
Number of bank branches per capita in 1999*Post-2006 dummy	0.488***	0.520***
	(0.023)	(0.031)
Region and year FE	YES	YES
Other controls	NO	YES
R-squared	0.961	0.975
Adjusted R-squared	0.960	0.973
F-test	35.58	11.75
	[0.000]	[0.000]
Observations	305	305

Note: robust standard errors clustered by district are in parentheses; p-values are reported in square brackets; F-test is the joint significance test for coefficients in the first two rows; banking system penetration is number of bank branches in a district per 5,000 persons. Explanatory variables reported are the number of bank branches in a district in 1999 per 5,000 persons interacted with (row-wise) (a) a 1999 time trend, (b) a post-2006 time trend, (c) a post-2006 dummy interacted with a post-2006 time trend. Other control variables included are population density, log of district welfare per capita, share of rural localities in a district, and human capital endowment, all measured in 1999. These controls enter the regression in the same way as bank branches per capita in 1999. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' construction.

In particular, between 1999 and 2006, an additional point of initial financial development in a district increases the per capita branch expansion in that district by 0.03 units annually. This means that, compared with less financially developed districts, about 0.03 units of additional bank branches per capita were opened annually in more financially developed districts in Ghana in the years prior to 2007. However, an important change in this relationship is observed in the post-2006 period. Between 2007 and 2013, financially less developed districts attracted relatively more bank branches than financially more developed districts. For instance, a unit decrease in a district's initial financial development leads to about a 0.02 unit increase in the number of bank branches per capita opened in that district, annually. This implies that, although banking system penetration into financially more developed districts continues unabated during the post-2006 period, the intensity with which this is done has been attenuated by the increased branch penetration into hitherto financially less developed districts in the post-2006 period. Considering the coefficient estimates presented in column I, we compute this incidence as 0.013 and it is significant at the conventional levels of statistical significance.[8]

However, a slightly different story exists when other control variables are included in the model (as in column II of Table 5). Even though the inclusion of the other control variables does not affect the significance of the initial financial development variables, it alters somewhat the magnitude of the respective coefficient estimates. The coefficient estimates in the first two rows of Table 5 (column II) show that the extent of banking system penetration into financially less developed districts is higher than that in financially more developed districts in the post-2006 period, with an incidence of about -0.001 (statistically significant at 1 per cent). This means that

[8] This is given by $\gamma_1 + \gamma_2$. F-test shows that $\gamma_1 + \gamma_2$ is significantly different from zero.

more bank branches are established in financially less developed districts than in financially more developed districts in the post-2006 period.

The inclusion of other control variables to capture district-specific characteristics as well as controlling for year- and region-fixed effects ensures that factors other than the change in the policy regime in the Ghanaian banking system are not driving the observed trends. Table A1 (in the Appendix) presents the full set of covariates included in the model of the determinants of banking system penetration. The evidence therein suggests that, unlike the initial financial development variable, the additional covariates (i.e. real district welfare per capita, population density of district, proportion of rural locations in a district, and level of human capital endowment of a district, all measured in 1999) do not exhibit a trend reversal with banking system penetration in the post-2006 period. Furthermore, the observed relationship between initial financial development and banking system penetration is robust to the exclusion of the Accra Metropolitan Assembly (AMA)—the district that includes the capital city of Ghana, Accra (see Table A2). There has been a large concentration of banks in the AMA over the years and this is partly due to the fact that almost all banks in Ghana launch in the capital city before opening branches in other locations.

Overall, our results therefore suggest some form of enhanced financial intermediation in financially backward districts during the post-2006 period. More importantly, they demonstrate that banking system penetration is significantly explained by our instrument (i.e. $B_{i1999} * [t - 2006]$). The empirical results demonstrate that the universal banking regime, unlike the hitherto compartmentalized banking regime, caused banks to branch out relatively more into less financially developed districts. This evidence shows that the theoretical weakness of our proposed instrument as highlighted before does not appear to be an issue. Consequently, we exploit this fact to provide an understanding of the impact of banking system penetration on financial inclusion. The result is robust to the use of the other two measures of banking system penetration, which we discussed in the previous section (see Tables A3 and A4).

6.2 Financial inclusion and initial financial development: reduced form evidence

To further check the robustness of our instrument we estimate models similar to equation (3) but utilize instead our measures of financial inclusion as the dependent variable. The idea is to illustrate that, unlike banking system penetration, our financial inclusion variables are not significantly related to initial financial development, especially during the post-2006 period. The reduced-form results[9] presented in Table 6 show the relationship between initial financial development and our two indicators of financial inclusion—i.e. the share of bank credit in total household credit (column I) and the share of formal credit in total household credit (column II). Overall, the results suggest that our financial inclusion indicators are unrelated with initial financial development both before 2006 and during the post-2006 period.

Specifically, the two main coefficients of our model (that is, the coefficients in the first two rows of Table 6) are all not significantly different from zero, at least at the conventional levels of statistical significance, 1 per cent, 5 per cent, and 10 per cent. Furthermore, the joint significance test for the coefficients in the first two rows (F-test) shows that the two coefficients are jointly insignificant, indicating that they do not jointly explain the behaviour of our financial inclusion variables. This indicates that the switch to a universal banking regime did not directly influence financial inclusion and thus provides the second rationale for the validity of our chosen instrument.

[9] The reduced-form model we estimated is: $F_{it} = \alpha_i + \beta_t + \lambda_t B_{i1999} + \delta_t X_{i1999} + u_{it}$.

The results obtained here are robust to the use of alternative measures of banking system penetration (see Tables A5 and A6). This finding, coupled with our earlier observation that banking system penetration exhibits a significant relationship with initial financial development, provides a strong basis for our identification strategy. Our instrument therefore possesses the two key properties of a valid instrument as highlighted by Angrist and Pischke (2008). The instrument (i.e. $B_{i1999} * [t - 2006]$) is relevant since it correlates strongly with the potentially endogenous variable—i.e. banking system penetration (Table 5). It is also strictly exogenous since it does not correlate with the dependent variable—i.e. our measures of financial inclusion (as shown in Table 6). The results thus far suggest that the change in the policy regime of the Ghanaian banking system impacts financial inclusion indirectly through its effect on banking system penetration. As a further check, however, we report the results of the tests for weak identification and endogeneity of the potentially endogenous regressor in our instrumental variable (IV) estimations (Tables A7–9).

Table 6: Financial inclusion as a function of initial financial development

	Financial inclusion	
Variables	**I**	**II**
	Share of bank credit	**Share of formal credit**
Number of bank branches per capita in 1999*(1999–2013) trend	-0.354	-0.120
	(0.232)	(0.354)
Number of bank branches per capita in 1999*(2006–2013) trend	-0.400	-0.083
	(0.511)	(0.569)
Number of bank branches per capita in 1999*Post-2006 dummy	7.018*	1.288
	(3.613)	(4.973)
Region and Year FE	YES	YES
Other controls	YES	YES
R-squared	0.228	0.441
Adjusted R-squared	0.164	0.394
F-test	1.58	0.07
	[0.210]	[0.935]
Observations	299	299

Note: robust standard errors clustered by district are in parentheses; p-values are reported in square brackets; F-test is the joint significance test for coefficients in the first two rows; banking system penetration is number of bank branches in a district per 5,000 persons; included explanatory variables are similar to those reported in Table 5. * p<0.1.

Source: authors' construction.

6.3 Financial inclusion and banking system penetration: instrumental variable evidence

In this sub-section, we provide a more structural analysis of the impact of banking system penetration on financial inclusion. More specifically, we illustrate whether increases in the number of bank branches per capita in a district affect the degree of financial inclusion in that district—with financial inclusion proxied by access to formal credit and bank credit. We present two types of findings: (i) the effect of banking system penetration on the share of bank credit in total household credit; and (ii) the effect of banking system penetration on the share of formal credit in total household credit. We estimate our models using both the simple Ordinary Least Squares

(OLS)[10] and the Two-Stage Least Squares (2SLS) estimation techniques. While the OLS estimations do not account for the endogeneity of banking system penetration in the model of financial inclusion, the 2SLS estimations correct for the potential endogeneity of banking system penetration in the model of financial inclusion.

Table 7 presents the empirical results on the effect of banking system penetration on financial inclusion. Model I of Table 7 presents the estimates of the effect of banking system penetration on the share of bank credit in total household credit, while Model II shows the effect of banking system penetration on the share of formal credit in total household credit. In Model I of Table 7, we present three types of results: column (1) reports the OLS estimations on the effect of banking system penetration on the share of bank credit in total household credit when other control variables are not included in the model, while column (2) reports same but with the inclusion of other control variables. In column (3), we present the instrumental variables (IV) results on the effect of banking system penetration on the share of bank credit in total household credit.

Similarly, in Model II of Table 7, we present three types of results: columns (4) and (5) report the OLS estimations on the effect of banking system penetration on the share of formal credit in total household credit without the inclusion of other control variables and with the inclusion of other control variables, respectively. Finally, column (6) (under Model II of Table 7) reports the results of the IV estimates on the effect of banking system penetration on the share of formal credit in total household credit. We provide further tests of the validity of our instrumentation strategy in the IV estimations. First, we present two weak identification test statistics—i.e. the first-stage F-statistic of excluded instruments and the Cragg-Donald Wald F-statistic. Second, we present the p-value of the endogeneity test. These statistics suggest that our instrument for banking system penetration is not weak and that banking system penetration is endogenous in our model of the determinants of financial inclusion.

Overall, our results illustrate strongly that banking system penetration promotes the level of financial inclusion, be it access to bank credit or access to formal credit. In particular, banking system penetration is significantly positively related with both the share of bank credit in total household credit and the share of formal credit in total household credit. For instance, in terms of the impact on the share of bank credit in total household credit, we observe that banking system penetration increases the share of bank credit in total household credit by approximately 52 per cent in the OLS estimations (see column (2), Model I of Table 7). This indicates that an increase in the number of bank branches per capita in a district raises the contribution of bank credit to total household credit by over 50 per cent. This can be explained by the fact that banking system penetration has the characteristic of increasing the proximity of banks to potential borrowers and hence reducing the cost of debt collection and monitoring. This could enhance bank lending.

Similarly, the result from our IV regression shows that banking system penetration raises the share of bank credit in total household credit by more than 76 per cent. The IV evidence shows that, without accounting for the potential endogeneity of banking system penetration in a model of financial inclusion, one runs the risk of underestimating the influence of banking system penetration on financial inclusion.

[10] The OLS estimation follows the model presented in equation (1)—i.e. $F_{it} = \alpha_i + \beta_t + \emptyset B_{it} + \varepsilon_{it}$.

Table 7: Financial inclusion and banking system penetration; OLS and IV estimates

	Model I			Model II		
	Share of bank credit			Share of formal credit		
	OLS		IV	OLS		IV
	(1)	(2)	(3)	(4)	(5)	(6)
Banking system penetration	0.048***	0.520***	0.769**	0.077***	0.425***	0.604**
	(0.011)	(0.164)	(0.315)	(0.026)	(0.140)	(0.245)
Number of bank branches per capita in 1999*(1999–2013) trend		-6.612***	-10.873*		-4.113**	-7.389
		(2.492)	(6.494)		(1.914)	(4.811)
Number of bank branches per capita in 1999*Post-2006 dummy		-1.754***	-2.415***		-1.440***	-1.895***
		(0.676)	(0.917)		(0.525)	(0.690)
Constant	0.081***	0.475***	0.457***	0.129***	0.697***	0.686***
	(0.022)	(0.074)	(0.073)	(0.026)	(0.058)	(0.064)
Region and year FE	YES	YES	YES	YES	YES	YES
Other controls	NO	YES	YES	NO	YES	YES
R-squared (within/uncentered)	0.246	0.270	0.781	0.483	0.135	0.869
Wald chi2/F-statistic	197.4	102.1	4.437	195	46.37	2.503
F 1st stage			714.11			714.11
Cragg-Donald Wald F-statistic			469			469
Endogeneity test (p-value)			0.002			0.005
Number of districts	102	102		102	102	
Observations	300	300	300	300	300	300

Note: robust standard errors clustered by district are in parentheses. Banking system penetration is number of bank branches in a district per 5,000 persons. Explanatory variables reported are: banking system penetration, the number of bank branches in a district in 1999 per capita interacted with (row-wise) (a) a 1999 time trend, (b) a post-2006 dummy interacted with a post-2006 time trend. In the IV estimations, the instrument is the number of bank branches per capita in 1999 interacted with a post-2006 time trend; The first-stage regressions corresponding to the IV estimations in columns (3) and (6) are reported in column II of Table 5. Other control variables included are population density, log of district welfare per capita, share of rural localities in a district, and human capital endowment, all measured in 1999; these controls enter the regression in the same way as bank branches per capita in 1999. R-squared (within) and the Wald chi2 statistics are reported for the OLS estimations while R-squared (uncentred) and the F-statistic are reported for the IV estimations. The weak identification test as represented by the Cragg-Donald Wald F-statistic and the p-value associated with the endogeneity test of the endogenous regressor are reported for the IV estimations. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' construction.

The results on the effect of banking system penetration on the share of formal credit in total household credit are qualitatively similar to the estimated effects of banking system penetration on the share of bank credit in total household credit. We find that an increase in the number of bank branches per capita in a district increases the share of formal credit in total household credit by about 60 per cent (see column (6), Model II of Table 7). This finding is robust to the use of alternative measures of banking system penetration (see Tables A7 and A8). This implies that banking system penetration improves households' access to formal credit. Put differently, the results suggest that opening an additional bank branch in a district improves the share of formal credit in total household credit.

The findings of this study line up with the results obtained by earlier scholars on the effect of rural banking system penetration on financial inclusion in India (Binswanger and Khandker 1995; Burgess and Pande 2005; Chakravarty and Pal 2013). The study by Burgess and Pande (2005), for instance, reveals that the rapid expansion of commercial bank branches in rural areas of India enhanced access to commercial bank credit. Thus, our results reinforce earlier findings on the positive role of banking system penetration in expanding access to formal financial services, notably formal credit, using data from Africa. Even though the supply of financial services is important in improving access to financial services, as evidenced in this study, it is also important not to lose sight of the significant role of demand-side factors in deepening the level of financial inclusion in Africa. Kumar et al. (2019), for instance, demonstrate the relative importance of demand-side factors (such as education, income, employment status, gender, and social norms) in promoting financial inclusion in India.

6.4 Robustness checks

As usual, we undertake robustness checks to ensure the soundness of our estimates. Specifically, we perform two main robustness checks on our estimations. First, as stated before, we estimate models similar to those presented in Tables 5 and 7 using two alternative measures of banking system penetration, that is (i) the number of bank branches in a district per capita measured by the total number of bank branches in a district divided by the district's population size in year 2000, and (ii) the number of bank branches in a district per capita measured by the total number of bank branches in a district divided by the district's land area. The results obtained by using these two alternative measures of financial inclusion mirror our main results. These results are presented respectively in Tables A3 and A4 (in the Appendix) as comparable estimates to Table 5; in Tables A5 and A6 as comparable estimates to Table 6; and in Tables A7 and A8 as comparable estimates to Table 7.

Second, in an attempt to avoid some of the challenges we encountered during the construction of the district-level data set from the fourth wave of the GLSS (see Section 5) and to check whether they exert any significant impact on our results, we depart from the use of the three-period panel data set to a two-period panel data set utilizing only the fifth and sixth waves of the GLSS. Using this two-period panel data set spanning the period 2005/06–2012/13, we show that our initial findings on both the reliability of our instrument as well as on the financial inclusion-enhancing effects of banking system penetration remain unchanged (see Table A9 for the OLS and IV estimates based on the two-period panel data set).

7 Conclusion

The importance of financial sector development and financial inclusion in the process of economic development is well documented. However, less is known about how developments in the financial sector and the banking industry in particular contribute to financial inclusion. This study examines the effect of banking system penetration on financial inclusion in terms of access to bank and formal credits. The current study is unique in two respects. First, it attempts to provide empirical evidence of a link between banking system penetration and financial inclusion using a longitudinal district-level data set from Africa. Second, the study exploits the change in the operational policy regime of Ghana's banking sector—which involved a switch from a compartmentalized system of banking to a universal banking system—in order to identify the effect of banking system penetration on financial inclusion.

The salient findings of the paper are as follows. First, we show that the move to a universal banking system in Ghana resulted in an expansion of the bank branch network, which has benefited hitherto financially less developed districts. Second, our instrumental variable evidence suggests that banking system penetration promotes financial inclusion. Specifically, banking system penetration improves the share of both bank credit and formal credit in total household credit, suggesting that the expansion of bank branches improves banks' engagement with the populace in terms of the provision of credit facilities to households. Finally, our results are robust to the alternative measures of banking system penetration, to the control for potential endogeneity bias, and to the change in data structure—i.e. a change in the length of our panel data set. Overall, akin to what has been observed elsewhere (notably in India: Burgess and Pande 2005), the paper demonstrates that banking system penetration promotes financial inclusion in Ghana. The paper therefore sheds light on the important topic of how policy can affect financial inclusion in developing countries.

A potential limitation of this study is that it has provided at best a partial analysis of the effect of banking system penetration on financial inclusion given that it focused on only one dimension of financial inclusion—i.e. access to credit facilities provided by formal financial intermediaries. This is due to the inadequate or unavailable information in our data set on the other dimensions of financial inclusion such as ownership of a formal bank account, ownership and use of a formal savings account, and access to insurance facilities provided by formal financial intermediaries. The data set used in this paper is, however, by far the best available that can support this type of analysis.

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Appendix

Table A1: Banking system penetration and financial inclusion as functions of initial financial development and other control variables (full sample estimates)

	Banking system penetration		Financial inclusion	
Variables	**I**	**II**	**Share of bank credit**	**Share of formal credit**
Number of bank branches per capita in 1999*(1999–2013) trend	0.030***	0.023***	-0.354	-0.120
	(0.004)	(0.006)	(0.232)	(0.354)
Number of bank branches per capita in 1999*(2006–2013) trend	-0.017***	-0.023***	-0.400	-0.083
	(0.003)	(0.005)	(0.511)	(0.569)
Number of bank branches per capita in 1999*Post-2006 dummy	0.488***	0.520***	7.018*	1.288
	(0.023)	(0.031)	(3.613)	(4.973)
Welfare per capita in 1999*(1999–2013) trend		-0.006	0.002	0.003
		(0.004)	(0.007)	(0.010)
Population density in 1999*(1999–2013) trend		0.014	0.064*	0.067
		(0.009)	(0.033)	(0.041)
Proportion of rural locations in 1999*(1999–2013) trend		0.017	-0.004	-0.006
		(0.029)	(0.008)	(0.014)
Human capital in 1999*(1999–2013) trend		-0.094	0.012	0.039*
		(0.064)	(0.015)	(0.024)
Welfare per capita in 1999*(2006–2013) trend		0.094**	0.008	0.003
		(0.029)	(0.007)	(0.010)
Population density in 1999*(2006–2013) trend		0.008**	0.049	0.012
		(0.003)	(0.037)	(0.044)
Proportion of rural locations in 1999*(2006–2013) trend		-0.048*	0.013	0.018
		(0.027)	(0.013)	(0.013)
Human capital in 1999*(2006–2013) trend		0.049	0.006	-0.001
		(0.060)	(0.024)	(0.031)
Welfare per capita in 1999*Post-2006 dummy		-0.086	-0.001	0.022
		(0.062)	(0.018)	(0.023)
Population density in 1999*Post-2006 dummy		-0.078	-0.000*	-0.085
		(0.146)	(0.000)	(0.097)
Proportion of rural locations in 1999*Post-2006 dummy		0.014*	-0.016	-0.023
		(0.008)	(0.026)	(0.035)
Human capital in 1999*Post-2006 dummy		-0.078	-0.039	-0.048
		(0.077)	(0.038)	(0.047)
Constant	0.030***	0.008	-0.801	0.131
	(0.010)	(0.014)	(1.260)	(1.734)
Region and year FE	YES	YES	YES	YES
Other controls	NO	YES	YES	YES
R-squared	0.961	0.975	0.231	0.447
Adjusted R-squared	0.960	0.973	0.157	0.394
F-statistic	9270.89	17736.98	8.81	34.61
Observations	305	305	299	299

Note: robust standard errors clustered by district are in parentheses; banking system penetration is number of bank branches in a district per 5,000 persons. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' construction.

Table A2: Banking system penetration and financial inclusion as functions of initial financial development and other control variables (excluding AMA)

	Banking system penetration		Financial inclusion	
Variables	**I**	**II**	**Share of bank credit**	**Share of formal credit**
Number of bank branches per capita in 1999*(1999–2013) trend	0.022***	0.021***	0.185	0.556
	(0.002)	(0.002)	(0.495)	(0.660)
Number of bank branches per capita in 1999*(2006–2013) trend	-0.013***	-0.012***	-0.247	-0.053
	(0.001)	(0.002)	(0.497)	(0.532)
Number of bank branches per capita in 1999*Post-2006 dummy	0.386***	0.122***	-9.312	-1.028
	(0.116)	(0.055)	(12.426)	(1.253)
Welfare per capita in 1999*(1999–2013) trend		-0.024	0.001	0.001
		(0.018)	(0.007)	(0.010)
Population density in 1999*(1999–2013) trend		0.049***	0.035	0.052
		(0.012)	(0.034)	(0.042)
Proportion of rural locations in 1999*(1999–2013) trend		-0.013	-0.003	-0.003
		(0.015)	(0.008)	(0.015)
Human capital in 1999*(1999–2013) trend		0.030	0.012	0.036
		(0.033)	(0.015)	(0.024)
Welfare per capita in 1999*(2006–2013) trend		0.036*	0.007	0.004
		(0.019)	(0.006)	(0.010)
Population density in 1999*(2006–2013) trend		0.011	0.038	0.017
		(0.117)	(0.037)	(0.042)
Proportion of rural locations in 1999*(2006–2013) trend		-0.029	0.013	0.018
		(0.128)	(0.013)	(0.013)
Human capital in 1999*(2006–2013) trend		-0.060*	0.005	0.002
		(0.033)	(0.024)	(0.031)
Welfare per capita in 1999*Post-2006 dummy		0.022	0.004	0.025
		(0.036)	(0.018)	(0.023)
Population density in 1999*Post-2006 dummy		0.031***	-0.044	-0.057
		(0.004)	(0.087)	(0.078)
Proportion of rural locations in 1999*Post-2006 dummy		0.031	-0.022	-0.028
		(0.036)	(0.028)	(0.038)
Human capital in 1999*Post-2006 dummy		-0.080**	-0.038	-0.046
		(0.035)	(0.038)	(0.047)
Constant	0.022***	0.023***	-0.725	1.823
	(0.007)	(0.008)	(1.426)	(2.099)
Region and year FE	YES	YES	YES	YES
Other controls	NO	YES	YES	YES
R-squared	0.815	0.934	0.223	0.441
Adjusted R-squared	0.806	0.928	0.148	0.387
F-statistic	95.87	1022.61	5.69	13.73
Observations	303	303	297	297

Note: robust standard errors clustered by district are in parentheses; banking system penetration is number of bank branches in a district per 5,000 persons; *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' construction.

Table A3: Banking system penetration as a function of initial financial development

	Banking system penetration	
Variables	**I**	**II**
Number of bank branches per capita in 1999*(1999–2013) trend	0.187***	0.173***
	(0.009)	(0.009)
Number of bank branches per capita in 1999*(2006–2013) trend	-0.136***	-0.141***
	(0.013)	(0.006)
Number of bank branches per capita in 1999*Post-2006 dummy	0.126***	0.063***
	(0.038)	(0.020)
Region and year FE	YES	YES
Other controls	NO	YES
R-squared	0.711	0.839
Adjusted R-squared	0.697	0.826
F-test	238.28	277.09
	[0.000]	[0.000]
Observations	306	306

Note: robust standard errors clustered by district are in parentheses; p-values are reported in square brackets; F-test is the joint significance test for coefficients in the first two rows; banking system penetration is number of bank branches in a district per the 2000 population size of the district. Included explanatory variables are similar to those reported in Table 5. *** p<0.01.

Source: authors' construction.

Table A4: Banking system penetration as a function of initial financial development

	Banking system penetration	
Variables	**I**	**II**
Number of bank branches per capita in 1999*(1999–2013) trend	0.245***	0.241***
	(0.004)	(0.005)
Number of bank branches per capita in 1999*(2006–2013) trend	-0.140***	-0.139***
	(0.003)	(0.003)
Number of bank branches per capita in 1999*Post-2006 dummy	0.370***	0.245***
	(0.020)	(0.022)
Region and year FE	YES	YES
Other controls	NO	YES
R-squared	0.983	0.992
Adjusted R-squared	0.982	0.991
F-test	1850.54	2370.81
	[0.000]	[0.000]
Observations	306	306

Note: robust standard errors clustered by district are in parentheses; p-values are reported in square brackets; F-test is the joint significance test for coefficients in the first two rows; banking system penetration is number of bank branches in a district per the land area of the district. Included explanatory variables are similar to those reported in Table 5. *** p<0.01.

Source: authors' construction.

Table A5: Financial inclusion as a function of initial financial development

Variables	Financial inclusion	
	I	II
	Share of bank credit	Share of formal credit
Number of bank branches per capita in 1999*(1999–2013) trend	0.267	0.254
	(0.254)	(0.294)
Number of bank branches per capita in 1999*(2006–2013) trend	0.018	-0.074
	(0.255)	(0.297)
Number of bank branches per capita in 1999*Post-2006 dummy	-1.101	-0.473
	(0.697)	(0.678)
Region and year FE	YES	YES
Other controls	YES	YES
R-squared	0.237	0.442
Adjusted R-squared	0.173	0.396
F-test	0.56	0.39
	[0.576]	[0.677]
Observations	300	300

Note: robust standard errors clustered by district are in parentheses; p-values are reported in square brackets; F-test is the joint significance test for coefficients in the first two rows; banking system penetration is number of bank branches in a district per the 2000 population size of the district. Included explanatory variables are similar to those reported in Table 6.

Source: authors' construction.

Table A6: Financial inclusion as a function of initial financial development

Variables	Financial inclusion	
	I	II
	Share of bank credit	Share of formal credit
Number of bank branches per capita in 1999*(1999–2013) trend	-0.001	-0.095
	(0.093)	(0.111)
Number of bank branches per capita in 1999*(2006–2013) trend	-0.011	-0.089
	(0.071)	(0.102)
Number of bank branches per capita in 1999*Post-2006 dummy	0.081	0.373***
	(0.296)	(0.136)
Region and Year FE	YES	YES
Other controls	YES	YES
R-squared	0.227	0.442
Adjusted R-squared	0.162	0.395
F-test	0.01	1.14
	[0.989]	[0.323]
Observations	300	300

Note: robust standard errors clustered by district are in parentheses; p-values are reported in square brackets; F-test is the joint significance test for coefficients in the first two rows; banking system penetration is number of bank branches in a district per the land area of the district. Included explanatory variables are similar to those reported in Table 6.

Source: authors' construction.

Table A7: Financial inclusion and banking system penetration; OLS and IV estimates

	Model I			Model II		
	Share of bank credit			Share of formal credit		
	OLS		IV	OLS		IV
	(1)	(2)	(3)	(4)	(5)	(6)
Banking system penetration	0.108**	0.411***	1.087*	0.256***	0.333**	1.070***
	(0.046)	(0.158)	(0.574)	(0.052)	(0.135)	(0.401)
Number of bank branches per capita in 1999*(1999–2013) trend		0.356	-0.569		0.591	-0.969
		(0.453)	(0.927)		(3.884)	(0.685)
Number of bank branches per capita in 1999*Post-2006 dummy		-1.639*	-1.792*		-7.065	-0.770
		(0.926)	(0.926)		(7.327)	(0.832)
Constant	0.075***	0.473***	0.412***	0.113***	0.692***	0.630***
	(0.023)	(0.077)	(0.086)	(0.026)	(0.059)	(0.072)
Region and year FE	YES	YES	YES	YES	YES	YES
Other controls	NO	YES	YES	NO	YES	YES
R-squared (within/uncentered)	0.247	0.261	0.776	0.494	0.125	0.861
Wald chi2/F-statistic	108.9	122.4	4.599	267.4	47.41	2.203
F 1st stage			488.26			488.26
Cragg-Donald Wald F-statistic			81.99			81.99
Endogeneity test (p-value)			0.115			0.022
Number of districts	102	102	102	102	102	102
Observations	300	300	300	300	300	300

Note: robust standard errors clustered by district are in parentheses; banking system penetration is number of bank branches in a district per the 2000 population size of the district. Included explanatory variables are similar to those reported in Table 7. R-squared (within) and the Wald chi2 statistics are reported for the OLS estimations while R-squared (uncentered) and the F-statistic are reported for the IV estimations. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' construction.

Table A8: Financial inclusion and banking system penetration; OLS and IV estimates

	Model I Share of bank credit			Model II Share of formal credit		
	OLS		IV	OLS		IV
	(1)	(2)	(3)	(4)	(5)	(6)
Banking system penetration	0.266***	0.021**	0.031***	0.455***	0.025***	0.033**
	(0.054)	(0.009)	(0.010)	(0.147)	(0.007)	(0.014)
Number of bank branches per capita in 1999*(1999–2013) trend		-0.003	-0.005**		-0.003***	-0.004*
		(0.002)	(0.002)		(0.001)	(0.003)
Number of bank branches per capita in 1999*Post-2006 dummy		-0.007**	-0.010***		-0.008***	-0.010***
		(0.003)	(0.003)		(0.003)	(0.004)
Constant	0.081***	0.005***	0.005***	0.128***	0.007***	0.007***
	(0.022)	(0.073)	(0.001)	(0.026)	(0.001)	(0.001)
Region and year FE	YES	YES	YES	YES	YES	YES
Other controls	NO	YES	YES	NO	YES	YES
R-squared (within/uncentered)	0.244	0.259	0.780	0.483	0.133	0.869
Wald chi2/F-statistic	268.7	127.9	4.659	195.5	45.19	2.487
F 1st stage			3053.71			70.31
Cragg-Donald Wald F-statistic			804.85			445.18
Endogeneity test (p-value)			0.029			0.078
Number of districts	102	102	102	102	102	102
Observations	300	300	300	300	300	300

Note: robust standard errors clustered by district are in parentheses; banking system penetration is number of bank branches in a district per the land area of the district. Included explanatory variables are similar to those reported in Table 7, R-squared (within) and the Wald chi2 statistics are reported for the OLS estimations while R-squared (uncentered) and the F-statistic are reported for the IV estimations. The weak identification test as represented by the Cragg-Donald Wald F-statistic and the p-value associated with the endogeneity test of the endogenous regressor are reported for the IV estimations. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' construction.

Table A9: Financial inclusion and banking system penetration; OLS and IV estimates (based on a two-period panel data set: 2005/06–2012/13)

	Model I			Model II		
	Share of bank credit			Share of formal credit		
	OLS		IV	OLS		IV
	(1)	(2)	(3)	(4)	(5)	(6)
Banking system penetration	0.023*	0.072***	0.075**	0.055***	0.049**	0.060*
	(0.013)	(0.025)	(0.035)	(0.017)	(0.022)	(0.034)
Number of bank branches per capita in 2006*(2006–2013) trend		-0.542	-0.563		0.907	0.854
		(0.945)	(1.083)		(0.691)	(0.753)
Constant	0.373***	1.436***	1.457***	0.719***	1.316***	1.401***
	(0.107)	(0.195)	(0.271)	(0.132)	(0.170)	(0.260)
Region and year FE	YES	YES	YES	YES	YES	YES
Other controls	NO	YES	YES	NO	YES	YES
R-squared (within/uncentered)	0.135	0.002	0.890	0.448	0.053	0.950
Wald chi2/F-statistic	35.54	33.26	1.303	135.5	12.22	0.567
F 1st stage			13.25			13.25
Cragg-Donald Wald F-statistic			59.04			59.04
Endogeneity test (p-value)			0.919			0.658
Number of districts	85	85	85	85	85	85
Observations	165	165	165	165	165	165

Note: robust standard errors clustered by district are in parentheses; banking system penetration is number of bank branches in a district per 5,000 persons. Included explanatory variables are similar to those reported in Table 7. R-squared (within) and the Wald chi2 statistics are reported for the OLS estimations while R-squared (uncentered) and the F-statistic are reported for the IV estimations. The weak identification test as represented by the Cragg-Donald Wald F statistic and the p-value associated with the endogeneity test of the endogenous regressor are reported for the IV estimations. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' construction.